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Federal Communications Commission
Washington, D.C. 20554

Dear Sirs,

Re.: Federal Register/Vol. 77, No. 217/Thursday, November 8, 2012/Proposed Rules

Interference between adjacent satellite networks is a major issue which needs to be properly regulated and energetically enforced, since it leads directly to important financial losses and causes disruption to a key service to the community. At the same time, this goal should be achieved without preventing innovation and causing unnecessary over-engineering of satellite earth stations.

Small antenna aperture for portable terminals is a promising area for the development of new satellite services. New high capacity Ka band satellites are able to provide large bandwidth for mass use of personal small terminals. Unlike terrestrial networks, these satellite services will provide almost global coverage including the oceans and emergency situation (i.e. natural disasters).

In our opinion, regulations of antennas for satellite earth stations in their current form could limit and even create some degree of confusion, among developers of new terminals using very small antennas, who are naturally concerned about interference and about obtaining licensing of their earth stations.

In the first place, chapter FCC 25.132 regulates the verification of earth station performance standard referring to FCC 25.209 which limits the envelope of gain patterns of antennas. These templates are intended for the large earth station antennas of the fixed satellite service and compliance is not physically possible for small antennas (smaller than 50 wavelengths). However, interference between satellite networks will depend on EIRP spectral density (rather than gain). We recommend that FCC 25.132 refer to EIRP power density envelopes defined in FCC 25.138, FCC 25.218 and FCC 25.223 at least for all small antenna terminals without a waiver being required for not being compliant with FCC 25.209.

In the case of antennas operation on the 20/30GHz band, FCC 25.138 determines the EIRP spectral density of transmitting earth stations, which is perfectly compatible with the use of very small antenna and terminals. Small aperture antennas can be used provided that the power and bandwidth is limited to the levels regulated by FCC 25.138, leading to a reduction of the bandwidth efficiency in terms of bits per second per Hertz or/and system availability. We thoroughly agree with this approach as it will prevent interference to other satellite networks, leaving to the market the final decision about suitability of small antenna products with reduced bandwidth efficiency and availability.

However in case of 20/30GHz receiving antennas, section 25.138 (e) states that the pattern of the receive antenna is referred to FCC 25.209 to ensure the isolation from adjacent satellite interference. We would like to bring your attention to the fact that current FCC 25.138 transmit envelopes are defined for a minimum θ angle of 2° while FCC 25.209 which is referred to in FCC 25.138 (e) for the antenna receiving patterns defines envelopes which start at an angle of 1.5°. Additionally FCC 25.138 allows a 10dB higher level in the 48-85deg angle range. We would recommend that a note be added to FCC 25.138 (e) that the FCC 25.209 envelope apply for a starting angle of 2° and that 0dBi is allowed in the 48-85deg angle region. Furthermore, electrically small antennas (smaller than 50 wavelengths) will not comply with gain templates from FCC 25.209, however they can provide enough adjacent satellite isolation reducing bandwidth efficiency (using the right type of modulation, coding, etc) in a similar way to the transmitting antenna case could do reducing its EIRP spectral density. We recommend to remove in 25.138 (e) the reference to FCC 25.209 for small receiving antennas provided that besides the 20GHz band patterns, a justification (link budget) of the modem/modulation type used by the earth station is compatible with the level of adjacent satellite interference.

Finally, we would like to bring your attention to flat plate antenna technology (Rectangular shape) for small earth station antennas. Reflector antennas have been the overwhelmingly preferred technical solution for satellite earth stations mainly due to weight, cost and loss constraints for large antennas. Regulations reflect this fact, using pattern envelope templates to limit interference which are well suited for typical antenna reflector patterns.

In the case of small antenna terminals, the sidelobe configuration of the patterns of square or rectangular flat plates can provide outstanding low interference for adjacent satellite networks on the GSO. Reflector antennas with circular/elliptical profiles exhibit sidelobes in all radial directions from the main beam. In the case of square or low aspect ratio (<2:1) flat plate antennas, sidelobes are concentrated around the principal planes which are parallel to the rectangular antenna profile (see Figure 1 below). The pattern envelope only a few degrees (depending on antenna size) away from the principal planes exhibits a rapidly decaying monotonic sidelobe profile, which leads to a far lower level of interference than that produced by a similarly sized reflector antenna. This characteristic of a reflector is to radiate a broadly equal power through its sidelobes in all directions at a given angle from the direction of the main beam.

During operation of the flat plate antenna, the user should assure that the earth station is rotated to align the GSO away from the principal planes of the antenna, leading to low levels of interference (compared to reflector antennas of similar or larger sizes) with geostationary satellite networks. In the case of non GSO satellites, sidelobes in the principal planes of the flat plate may cause interference, however regulations to prevent interference do not take into account that flat plate sidelobes are restricted to a small region of solid angle.

In the case of 20/30GHz band, FCC 25.138 defines EIRP spectral density templates off GSO intended to protect non GSO satellites. Flat plate antennas that transmit at the same frequency, but which are pointed at different geostationary satellites should not align in general their principal planes to the same direction in space, if there is a requirement to minimise the peak interference outside the GSO arc (i.e. potentially in the direction of non GSO satellites). However, it is noted that non GSO satellites will only cross the principal planes of the flat plate over a limited period of time as they fly in orbits which are not synchronised with the rotation of the earth and hence appear to move across the sky from a given fixed location on the earth.

In the case of more than one antenna transmitting using Code Division Multiple Access (CDMA) modulation schemes, which is pointing to the same GSO satellite, FCC 25.138 considers a 10log(N) contribution to account for all the simultaneous earth station causing interference. However, in the case of flat plate antennas, it is feasible to contemplate randomised antenna rotation (i.e. fixing different rotation setting for the terminal) in order to ensure that all principal planes for all N users are not aligned (see Figure 2). In this case, it would more accurate to remove the 10log(N) term (only for rectangular flat plates) and require that FCC 25.138 EIRP spectral density template should be applied to the average of patterns for the N interfering users assuming that at least one is causing interference through the principal plane.

Given the above, we would be grateful if FCC could consider issuing a specific license (not just a waiver) to be applied to small flat plate antennas. We understand that any allowance on satellite network interference cannot be taken lightly, but we believe this might boost the market of very small earth station antennas and support the early adoption of approaches minimising potential interference issues, such as for example the combination of CDMA and randomised antenna rotation.

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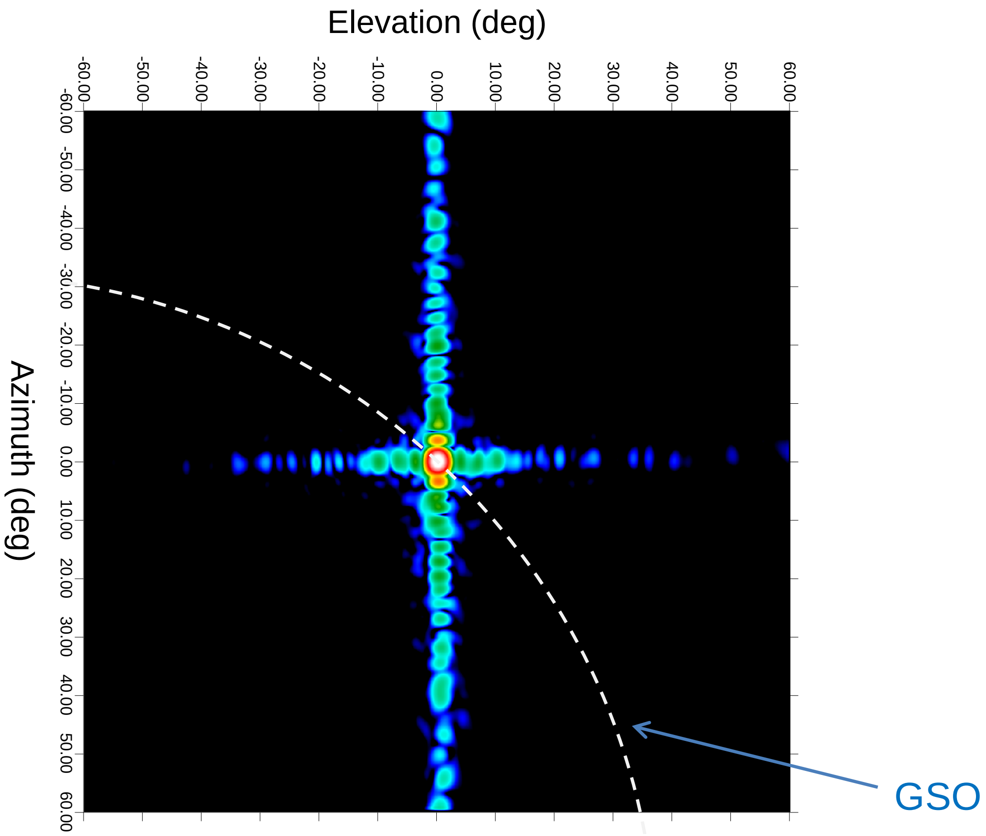

Figure 1: Example of flat plate 2D pattern showing sidelobe configurations

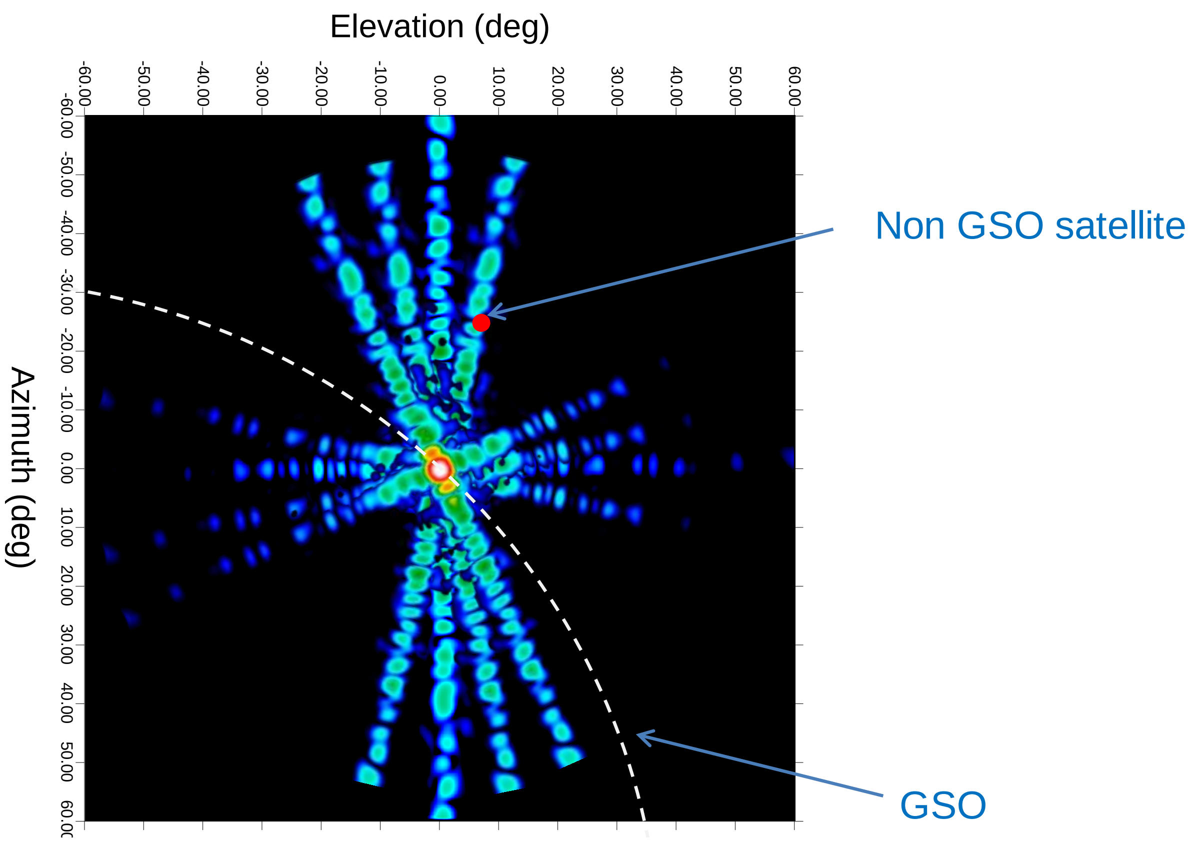

Figure 2: **Multiple flat plate antenna patterns**